

# BIOFRAG research topic

## Biodiversity Pattern and Process of Coral Reef in Indonesia: a case study in Bunaken Island and its adjacent coast

### Background:

Indonesia is an archipelagic country that consists of thousands of big and small islands with their coastline estimated more than 81000 kilometres. Most of the islands are surrounded by coral reefs. Scientists believe that Indonesian coral reefs are among the richest in the world with regard to their diversity or species richness. Unfortunately coral reefs weak to anthropogenic and natural disturbances such as: pollution from the land, destructive fishing practises, sedimentation, tsunami, bleaching due to global warming and others. Those threats cause reef suffers and time to time it decrease significantly. The reef status is commonly measured and judged based on its biodiversity.

Studying reefs biodiversity usually is done by direct survey using SCUBA diving or just snorkel with the method of line transect for corals, visual census for reef fish, sampling quadrat for sea grass, square or vein grab for foraminifera and others. Reefs biodiversity survey based on those methods are time consuming and not suitable for Indonesian reefs which are very huge in coverage. Satellite data which provide a synoptic image of shallow seas water is promise able to be employed to map reefs biodiversity.

### Research questions

- How do benthic characteristic i.e. live coral cover, number of benthic categories and dominant benthic substrate relate to the biodiversity of coral and foraminifera?
- How many benthic categories can be derived from remote sensed data?
- Do the biodiversity of coral and foraminifera change along with the gradient of the form of reef-front, reef exposure and depth?
- How do the biodiversity of coral and foraminifera relate to coastal types and reef geomorphology?
- How do water qualities i.e. turbidity, chlorophyll a, total suspended matter, nitrate and phosphate influence the biodiversity of coral and foraminifera?

### Method

This proposed research is designed consisting of two stages. The first stage is aimed to investigate the link between environmental parameters and both coral and foraminifers' diversity taking place in the field. The relation between coral diversity and foraminifers' diversity in responding the gradient of environmental variables in the field will also be investigated.

The second one is aimed to investigate the relation between the environmental variables which can be derived from remote sensing and the coral and foraminifera diversity data collected from the field. At the same time the relation pattern is tested using the intermediate disturbance hypothesis and assessed whether it can be used to predict the distribution pattern of the coral and foraminifera diversity.

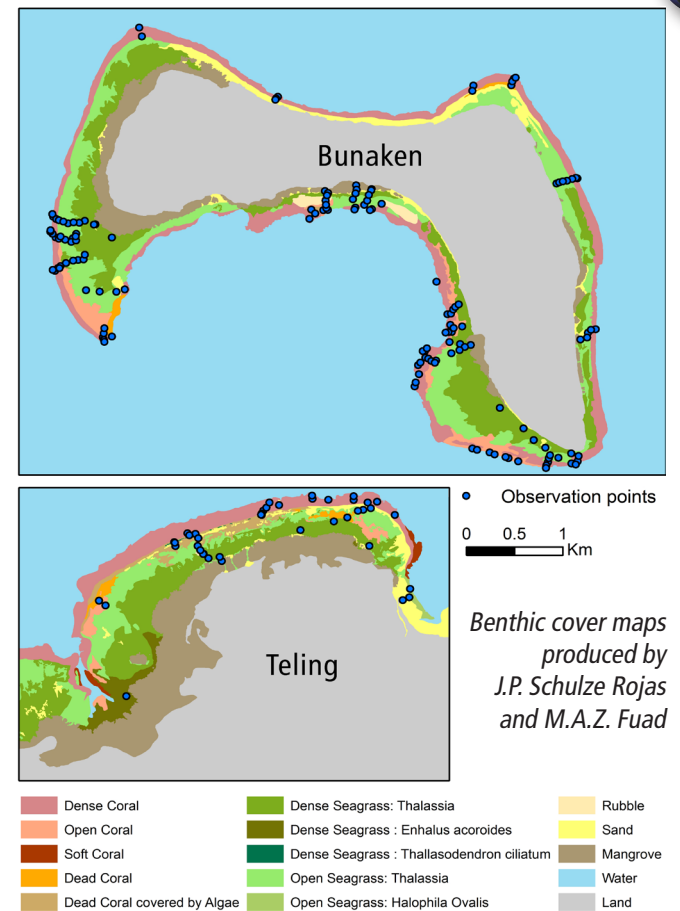
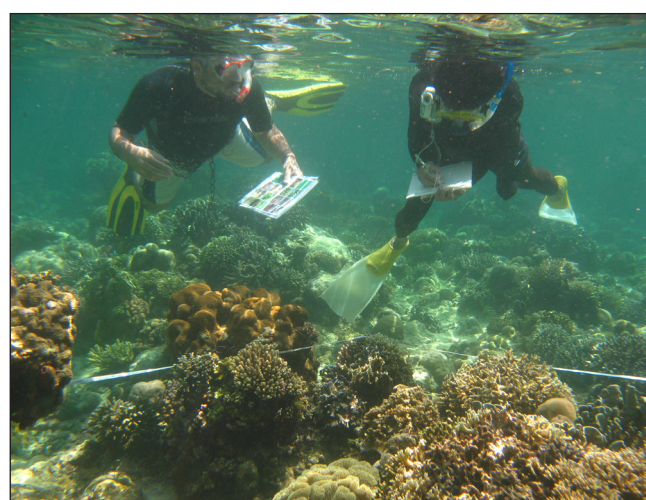


Image of the study area (image downloaded from Google Image).

In order to achieve those aims, fieldwork will be carried out to collect primary data i.e. coral and foraminifera as dependent variables, and data of environmental conditions as independent variables. Waterproof mobile GIS will be used for location on remote sensed data (accuracy of location 2m) and recording field observations. Coral and foraminifera diversity data is represented in genera richness. Environmental parameters in the field including physical conditions and water properties are determined as complete as possible. Environmental parameters will be collected and used for analysis.

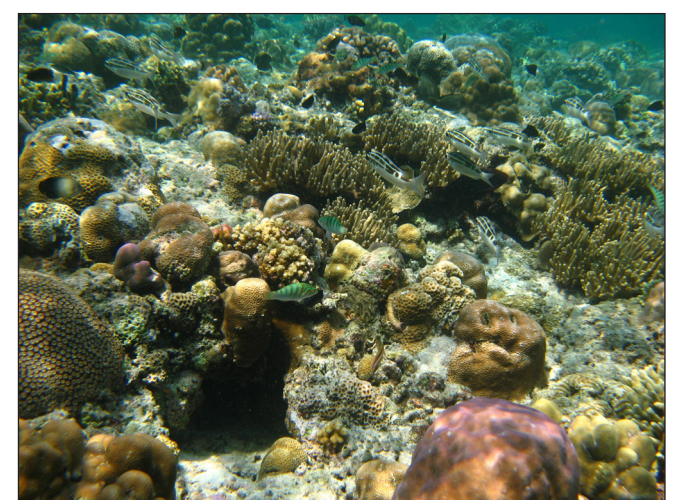
### Fieldwork area

The proposed study area is Bunaken National Park (BNP) located close to Manado City, North Sulawesi, Indonesia. The area of the BNP is about 890.65 km sq, because of that the study will only be focused on the reef of Bunaken Island and in the coast of Arakan - Wowontulap (AW) village, with the extension of some reef places inside Manado Bay. Both areas offer different kinds of shallow reef



flat habitats including fringing reefs, bay reefs and patch reefs. The localities also represent inshore and offshore reefs and has variation in exposure (sheltered and exposed reefs). During wet season where usually the wave is strong, the wind induce wave mostly come from northwest direction.

According to local media in recent day BNP is under pressure due to land-based pollution of sewage from Manado city as well as sedimentation from Tondano' river. Study done by Lasut et al. (2005) showing that water quality of Tondano' river was polluted and exceed the standard of water quality criteria. Activity such as land clearing for new settlement development in upland nowadays become more intensive was reported by the local media. The media (Kompas 2006) also reported that the water condition in BNP, especially around Bunaken Island, now becoming more dirty due to litter. Study done by Christie (2005) in BNP found that coral reefs in Bunaken Island was degraded but coral reefs condition in one of another islands inside the BNP where located far from the BNP management authority was surprisingly increased.



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